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The Role of Lattice Mismatch and Polar Fluctuation at the Conducting Oxide Interfaces ZHEN HUANG, NUSNNI-NanoCore, National University of Singapore, KUN HAN, Department of Physics, National University of Singapore; NUSNNI-NanoCore, National University of Singapore, SHENGWEI ZENG, MALLIKARJUNA MOTAPOTHULA, WEIMING LÜ, YONGLIANG ZHAO, CHANGJIAN LI, NUSNNI-NanoCore, National University of Singapore, WENXIONG ZHOU, Department of Physics, National University of Singapore; NUSNNI-NanoCore, National University of Singapore, MICHAEL COEY, School of Physics and CRANN, Trinity College; NUSNNI-NanoCore, National University of Singapore, THIRUMALAI VENKATESAN, NUSNNI-NanoCore, National University of Singapore; Department of Electrical and Computer Engineering, National University of Singapore, ARIANDO ARIANDO, Department of Physics, National University of Singapore; NUSNNI-NanoCore, National University of Singapore — Two key questions have been raised since the discovery of two-dimensional electron gas (2DEG) at the interface between insulating oxides LaAlO3 and SrTiO3. One is the origin for such 2DEG, and the other is how to improve carrier mobility. By replacing LaAlO3 with the cubic polar perovskite insulator (La0.3Sr0.7)(Al0.65Ta0.35)O3 (LSAT), carrier mobility can be increased by 30 times and reach 35,000 cm2V-1s-1 at 2 K, accompanied by reducing lattice mismatch from 2.98% to 0.96%. Moreover, two critical thicknesses for LSAT/SrTiO3(001) interface are found: one is 5 unit cells for 2DEG appearance, and the other is around 12 unit cells for carrier mobility optimization. This phenomenon can be explained in terms of polar fluctuation in LSAT(001), while the conducting (110)- and (111)-orientated LSAT/STO interfaces without such polar fluctuation shows less thickness-dependent carrier mobility.

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